Task K Report

DØ Experiment

- Personnel
- Detector
- Computing
- Physics

Jianming Qian

DOE review of Task K, July 21, 2003

Michigan Group

Faculty

• Jianming Qian	Computing, physics
• Homer Neal	Calibration database, remote processing
• Bing Zhou	Fast muon MC program, physics

Research physicists

• Andrew Alton	Fiber tracker/Preshower operation, physics
• Alan Magerkurth	Preshower algorithm development, physics
• Zhengguo Zhao	Preshower Level 2 firmware, physics

Graduate Students

• Chunhui Han	top cross section with matrix element method
• James Degenhardt	data reprocessing, physics

Other Contributors:

• Abhijit Bose, Jeremy Herr, Glenn Lopez, Brian Wickman, Qichun Xu

Primary Activities:

• Detector Operation:	fiber tracker, central preshower, trigger
• Computing & Software:	data reprocessing, Grid research, simulation
• Physics Analyses:	coordination, top physics, di-boson, QCD

Notes and Talks

Conference talks

Measurements of the W/Z production cross section at DØ
Alton: 14th Tropical Conf. On Hadron Collider Physics, Germany, September 2002

The matrix element method for measuring ttbar production cross section in the e+jets channel
Han: 2003 APS meeting, Philadelphia, April 2003

Run II startup: Tevatron, CDF, and DØ
Qian: IVth LHC symposium, Fermilab, May 2003

Publication, notes, and thesis

Phys. Rev. D 66, 032008 (2002) (based on Xu's thesis)
Direct Measurement of the W Boson Decay Width

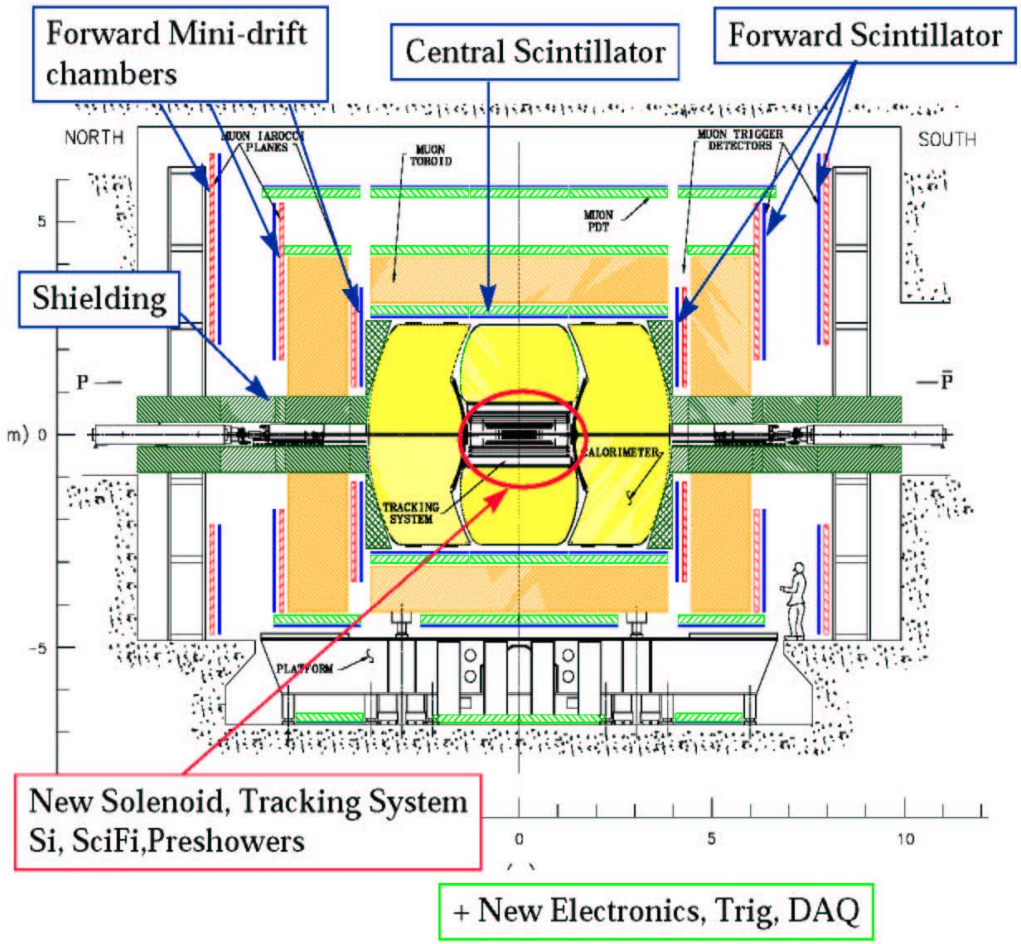
DØnote 4059, Zhou et al.
Status of the Fast Simulation PMCS

DØnote 4064, Zhou et al.,
Parameterized MC Simulation Muon Package

DØnote 4176, Zhao et al.,
Measurements of the Second Binomial Moment and the Fragmentation Function of Jets into Charged Hadrons

Han's thesis (to be defended tomorrow):
Measurement of top pair production cross section in electron+jets channel in ppbar collisions at sqrt(s)=1.96 TeV

Run II Detector



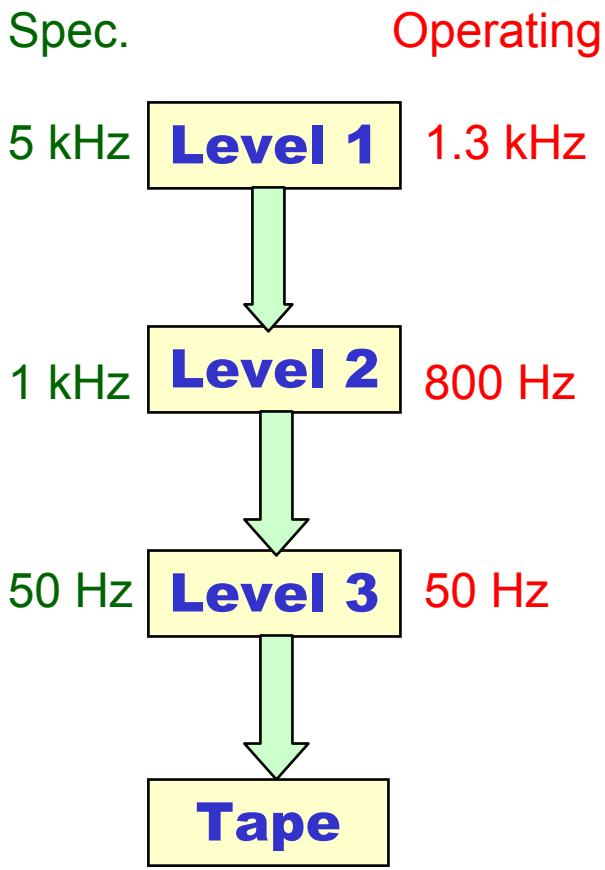
Retained from Run I

- LrAr calorimeter
- Central muon detector
- Muon toroid

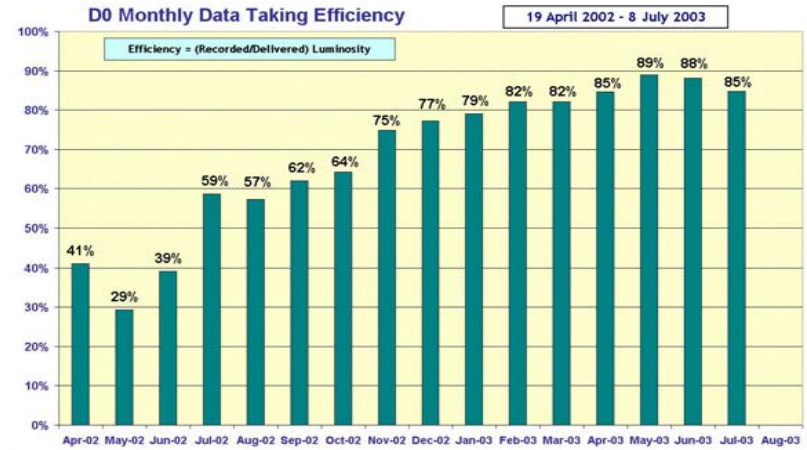
New for Run II

- Magnetic tracker
  - 2 Tesla solenoid
  - Silicon microvertex tracker
  - Scintillating fiber tracker
- Preshower detectors
- Forward muon detector
- Forward proton detector
- Front-end electronics
- Trigger and DAQ

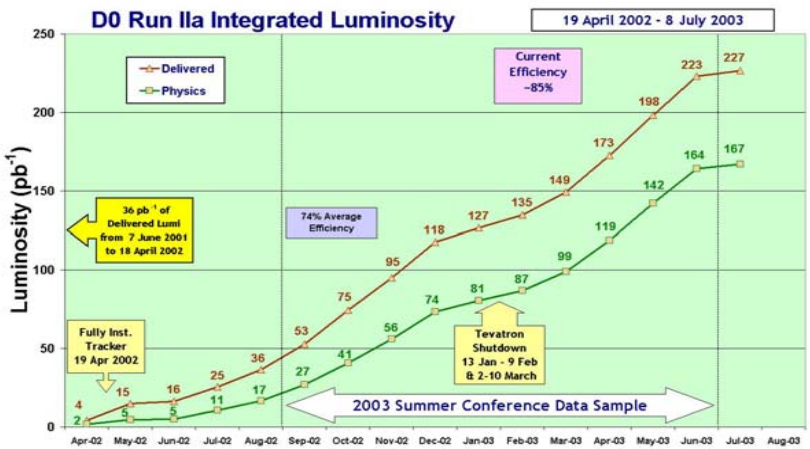
Trigger and DAQ



Track and vertex triggers integration underway



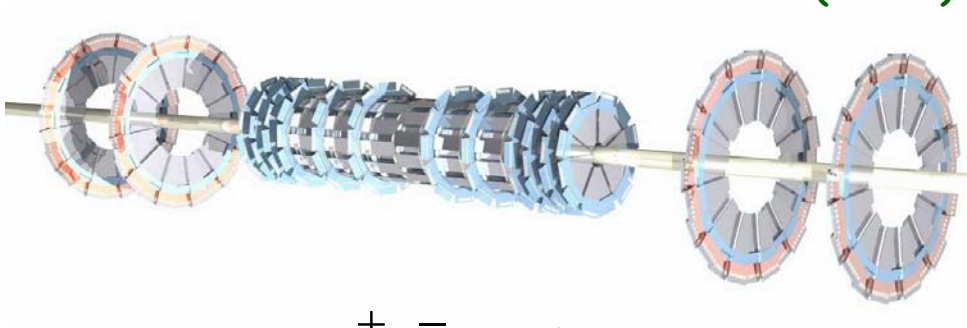
DAQ efficiency improved significantly, running routinely at ~85% now...



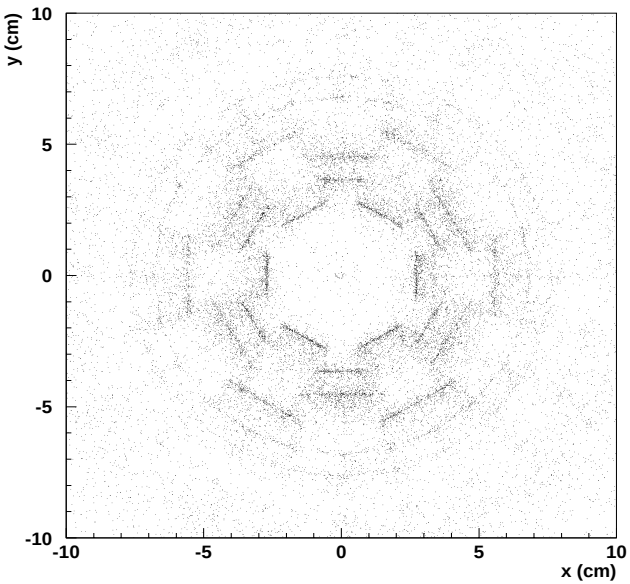
We have over 170 pb-1 on tape (Run I: ~ 130 pb-1)

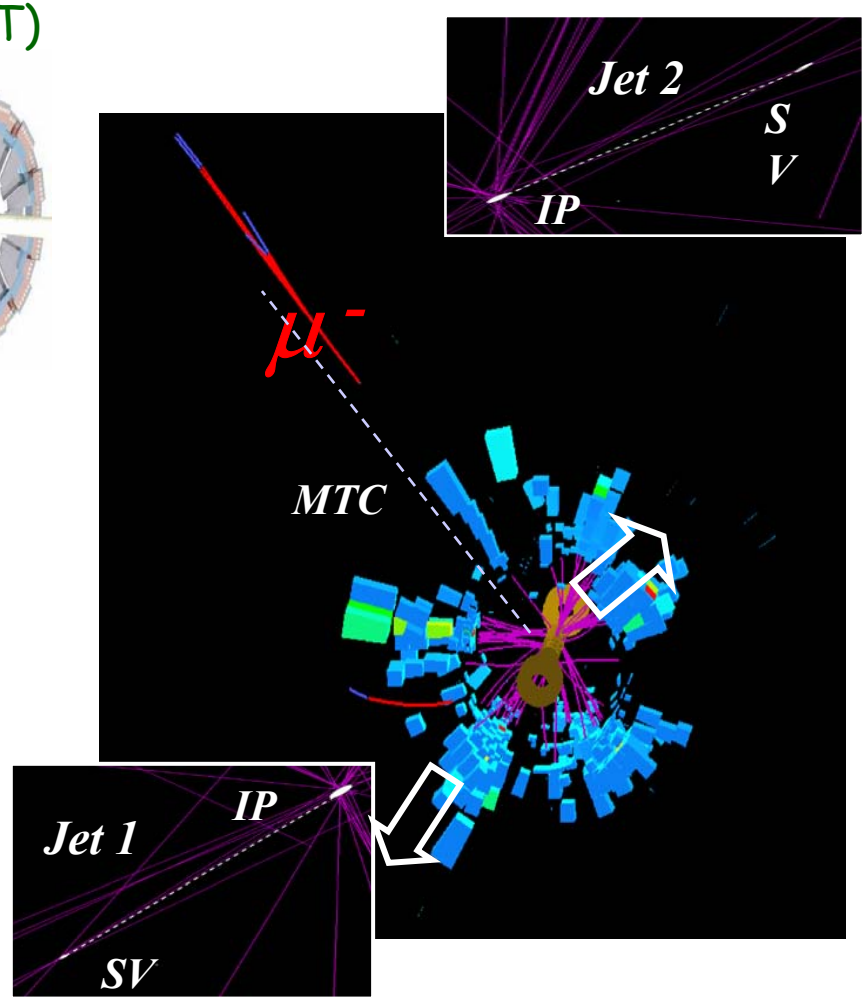
Vertexing Performance

Silicon Microvertex Detector (SMT)



$\gamma \rightarrow e^+e^-$ vertex

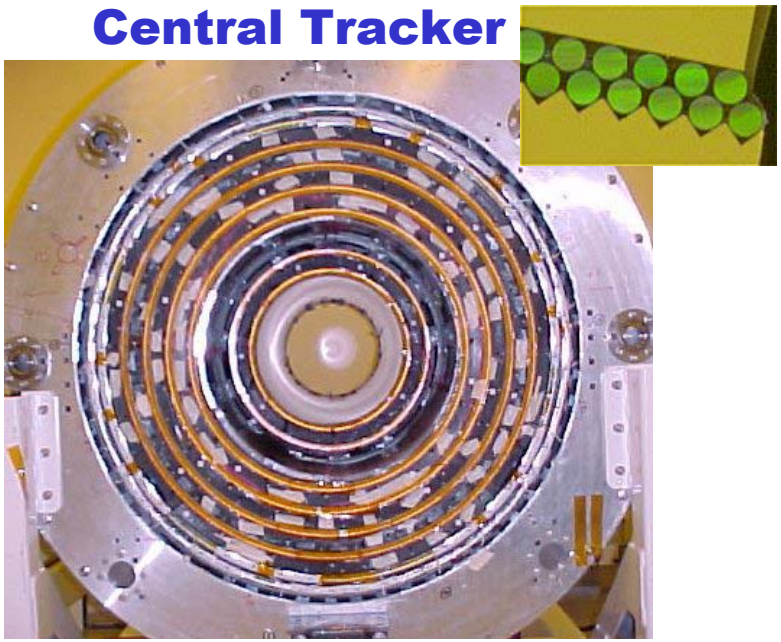




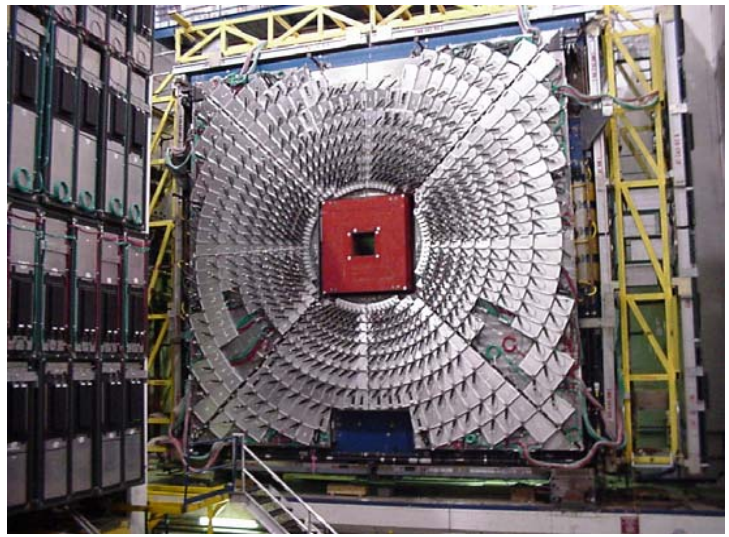
μ+jets top candidate

Tracking Performance

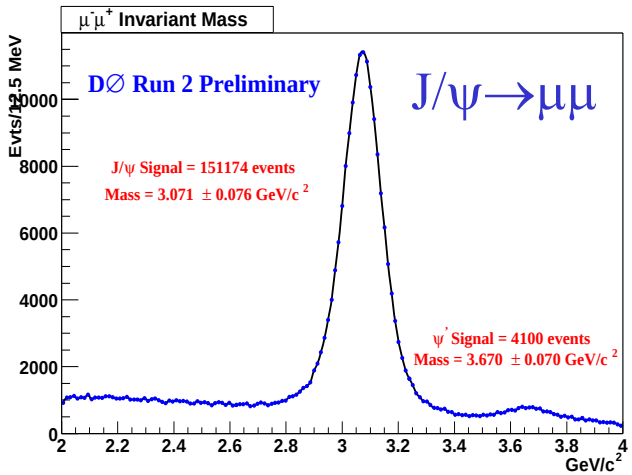
Central Tracker

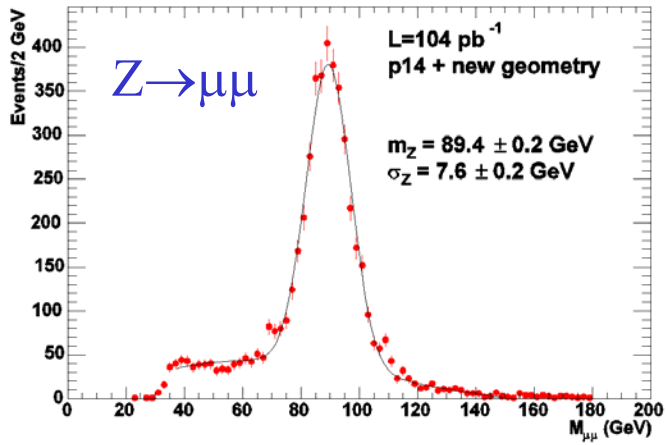


Muon Detector



$B\ell^2 \sim 0.5\ T\ m^2$



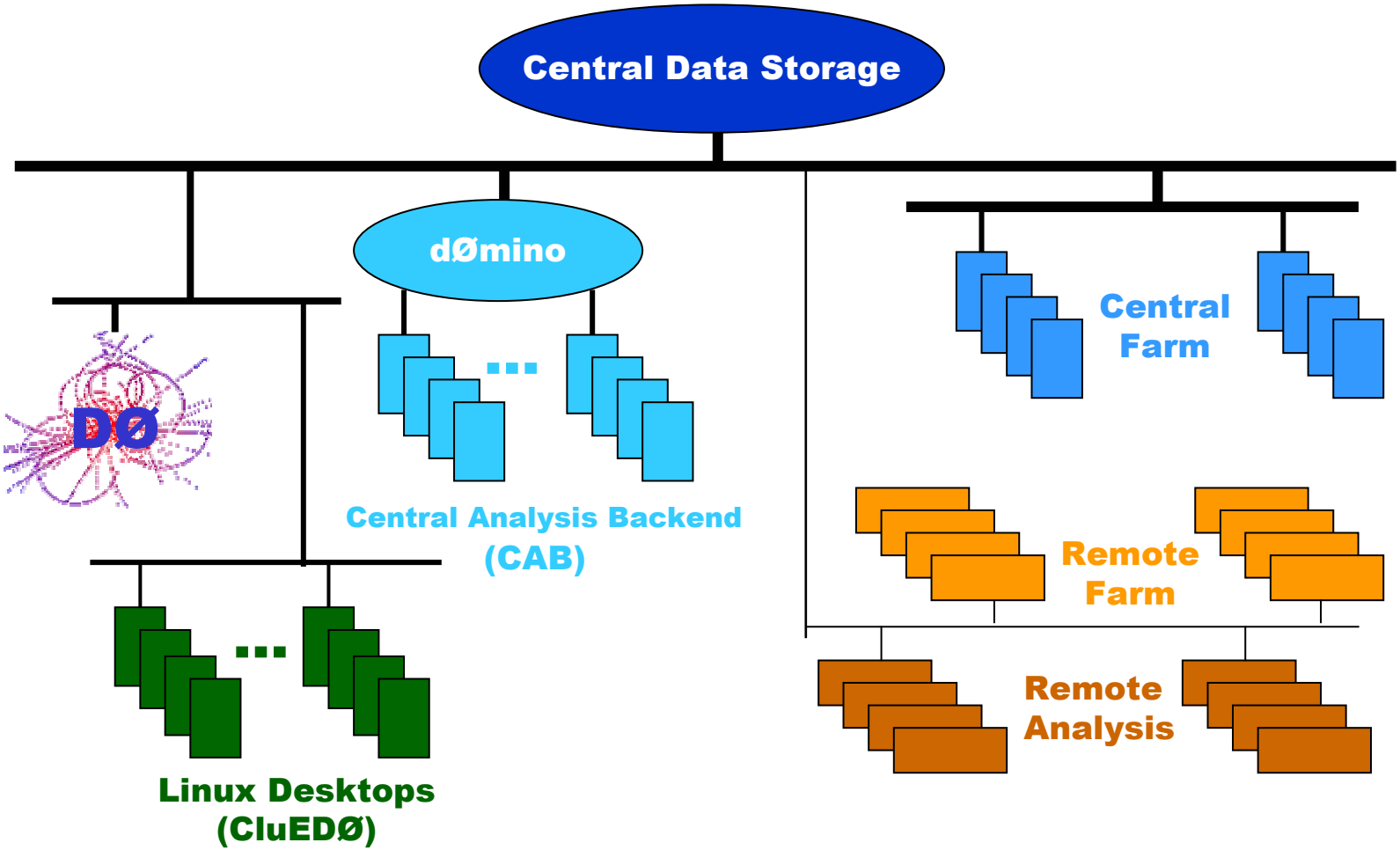


Central Preshower Detector

Designed, constructed, installed and is being operated by our group !

(See Alton's talk for its physics potentials...)

Computing Model



- Qian served as a co-leader of computing/software until Feb. 2003
- Led a group of five institutions to submit an ITR proposal to NSF
- Developing DØ's first offsite data reprocessing center

Data Intensive Grid

DØ has half-dozen MC sites in operation, scheduled manually, and will have at least 3 remote analysis centers (+Fermilab).

Integrate these systems in a user-transparent way is the challenge we are facing

- site-independent user tools (job submissions, control, ...)
- ability to submit jobs to any site from anywhere, ...

⇒ **This is the Grid...**

Tevatron vs LHC

- we have real data, real applications and real users now
- we can deploy Grid middleware and technology in the real word
- we can provide feedback of real-life experiences...

We submitted a medium ITR proposal "Data Intensive Grid at the Tevatron" in conjunction with Fermilab, Michigan State, UC Riverside, UT Arlington.

At Michigan, we are collaborating with Center for Advanced Computing and Center for Information and Technology Integration (CITI).

We hope NSF agrees with us...

Reprocessing & Hardware

Offsite Data Reprocessing:

Seek offsite resources to complement Fermilab for data reprocessing to take advantage of better algorithms, improved calibration/alignment etc.

We applied and granted 200,000 hours of CPU time by the National Partnership for Advanced Computing Infrastructure (NPACI) at Michigan's Center for Advanced Computing (CAC) for data reprocessing.

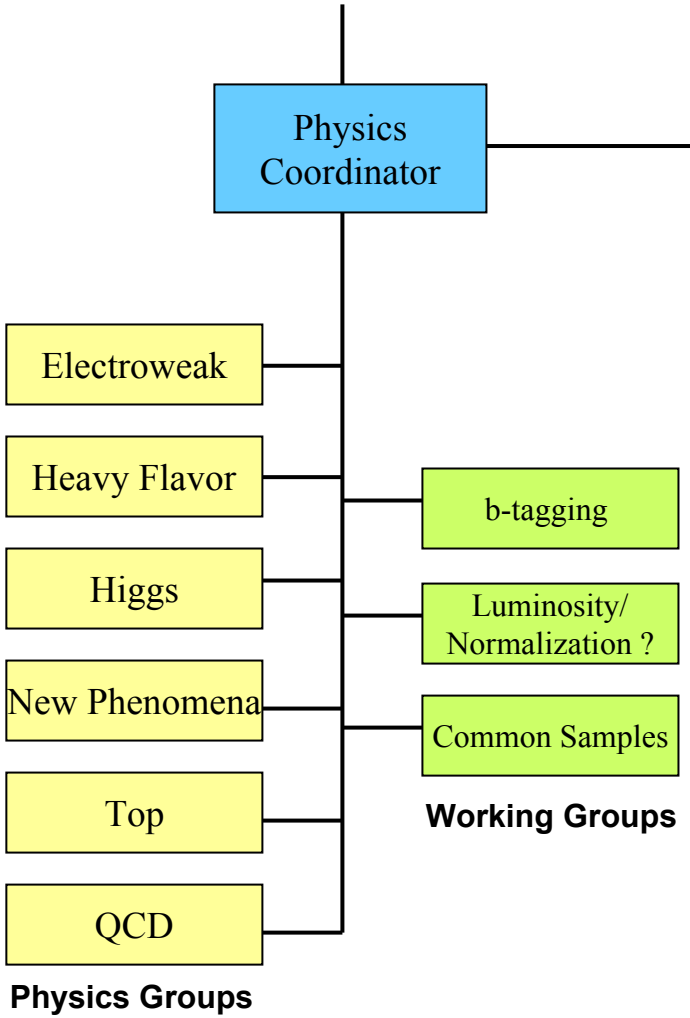
CAC staff (Abhijit Bose, Brian Wickman) have been helping us to deploy the first offsite reprocessing site at NPACI. We are now in production to reprocess about 50 million events this year.

Computing Equipment:

Using Task H equipment funds for computing equipment:

- **desktops and large disk/CPU servers to support analyses at Fermilab and in Ann Arbor**
- **increased CPU/disk demands as data size getting large and analyses getting more sophisticated**
- **upgrade a third of equipment on yearly basis...**

Physics Effort



Qian will lead DØ's physics effort after the Lepton-Photon conference and will be responsible for

- **all physics analyses**
- **conference presentations**
- **publications**

We are reorganizing to reduce duplication and improve efficiencies

Showcase two examples of new opportunities…
(Magerkurth will discuss Michigan analysis effort…)

Physics Menu

Top quark physics

Pair production cross section, mass and properties, single top production, ...

Electroweak

W/Z productions, di-boson production, W mass, charge asymmetries, ...

New phenomena searches

Higgs bosons, supersymmetry, leptoquark, large extra dimensions, W'/Z', ...

Heavy flavor

resonance reconstructions, masses, lifetimes, branching fractions, rare decays, B_s mixing, ...

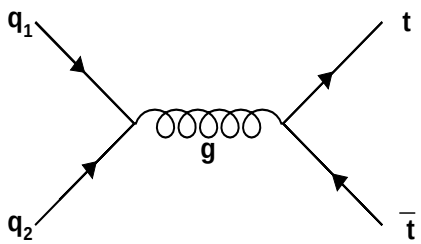
QCD

jet structure and cross sections, dijet mass distribution, photon production, diffractive physics, ...

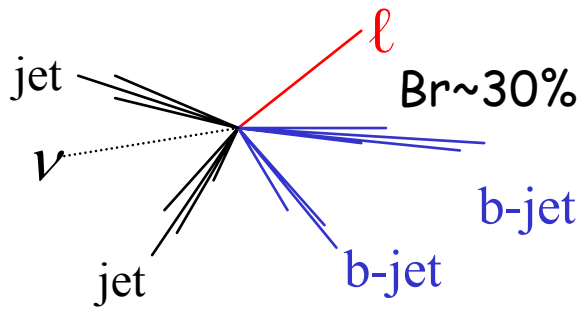
There is a lot of physics to be done now...

Lifetime Tag

Top pair production

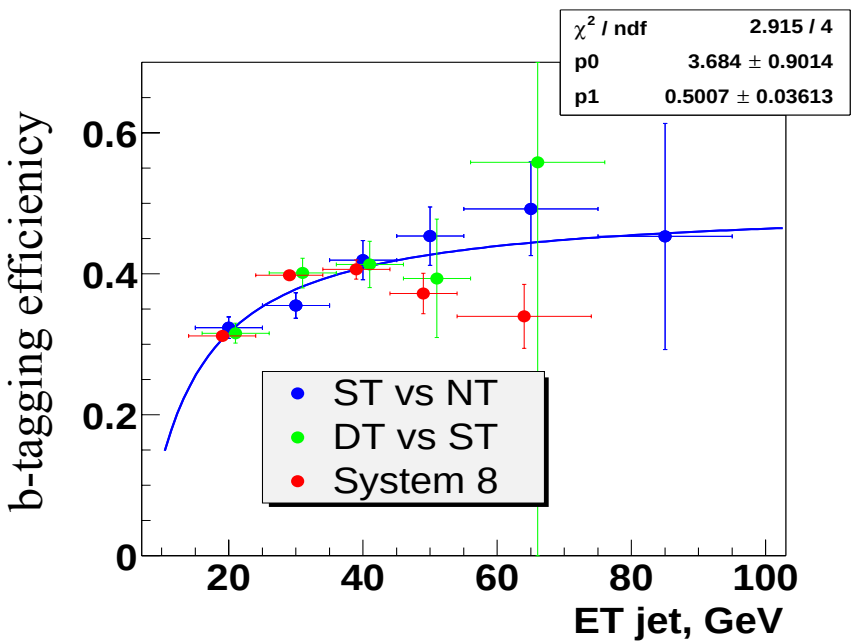


Lepton+jets events

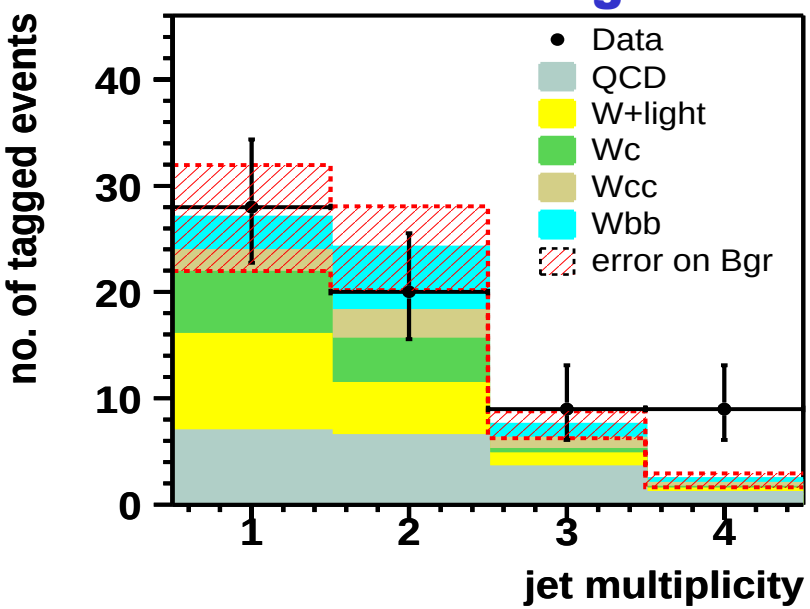


B-jet tagging:

• semi-leptonic • lifetime



First lifetime-tag result

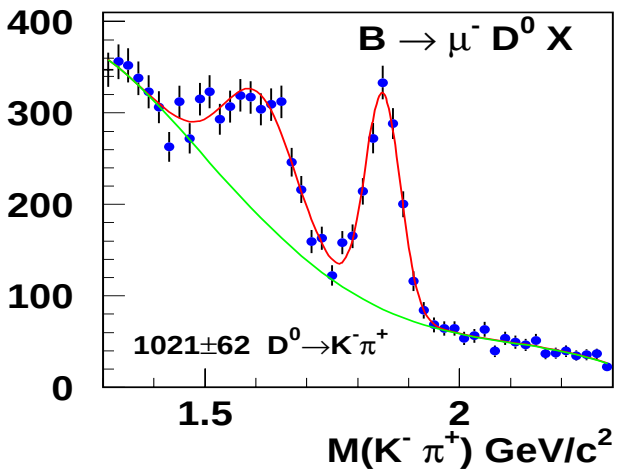


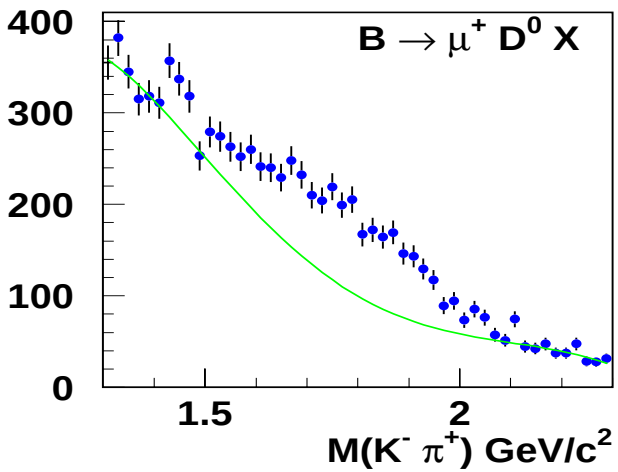
$$\sigma_{t\bar{t}} = 10.8^{+4.9}_{-4.0}(\text{stat})^{+2.1}_{-2.0}(\text{syst})\ \text{pb}$$

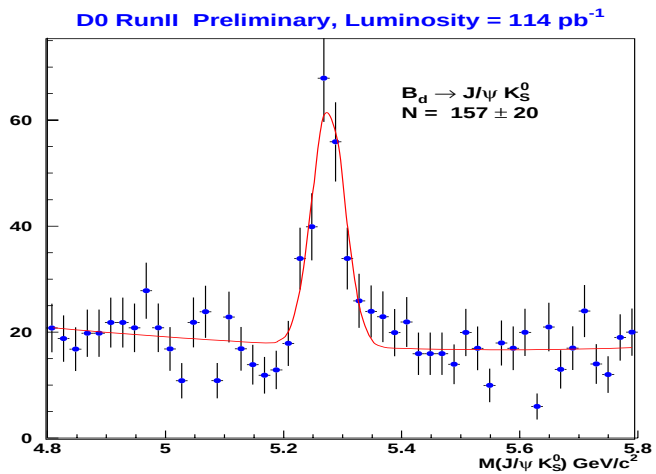
Resonances

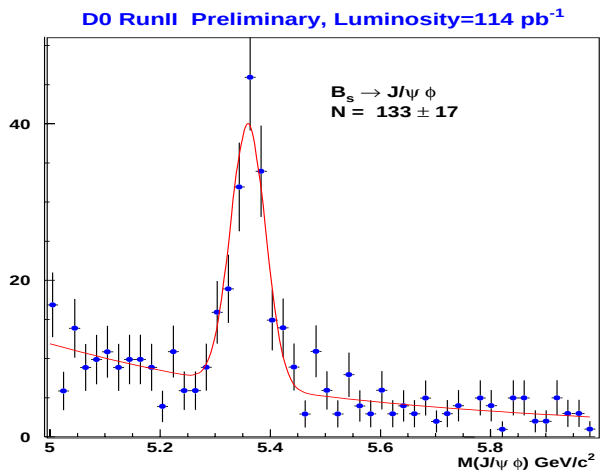
New opportunities in b/c physics…

D0 RunII Preliminary, Luminosity = 2.2 pb^{-1}









Summary

Tevatron physics opportunities is unmatched elsewhere
There are a lot of physics we can do NOW

Challenges for DØ

- better understanding of detector, particular the calorimeter
- improve reconstruction performance
- maximize physics output

Plan of Michigan/DØ group

- Operate and Calibrate the Central Preshower Detector
- Pursue Run II physics, coordinate DØ physics effort
- Grid research and operate a reprocessing site

Small group, large responsibilities…
We need continued DOE support